

CLAIMS:

1. A method of forming a hydrophobic coating on the surface of a substrate, the method comprising the steps of:
 - 5 (a) forming an emulsion comprising particulate material, a decomposable surfactant, water and an organic solvent;
 - (b) applying the emulsion to the surface to form a coating on the surface;
 - (c) exposing the coating to conditions such that all or substantially all of the water and the organic solvent are removed from the coating, and the particles of the particulate material become bound together and to the surface; and
 - (d) exposing the coating to conditions such that the decomposable surfactant decomposes.
- 15 2. A method according to claim 1 wherein the contact angle of water on the coating formed by the method is at least 130°.
3. A method according to claim 1 or 2 wherein the emulsion further comprises a linking agent capable of reacting with the particles of the particulate material and the surface to bind the particles together and to the surface.
- 20 4. A method according to claim 3 wherein the linking agent is a polymer or mixture of polymers capable of reacting with two or more of the particles to link the particles by a polymer strand, and capable of reacting with the surface and one or more of the particles to link the surface and the one or more particles by a polymer strand.
- 25 5. A method according to claim 3 wherein the linking agent is a monomer or mixture of monomers capable of reacting with the particles and the surface, and capable of forming a polymer strand linking two or more of the particles and capable of forming a polymer strand linking the surface and one or more of the particles.
- 30 6. A method according to claim 5 wherein the linking agent is methyltrimethoxysilane, vinyltrimethoxysilane, methyltris(methylethylketoximino)silane, methyltriacetoxy silane, ethyltriacetoxy silane or vinyltriacetoxy silane.

7. A method according any one of claims 1 to 6 wherein the emulsion further comprises a surface modifier capable of reacting with at least some of the particles of the particulate material to increase the hydrophobicity of the particles.
8. A method according to claim 7 wherein the surface modifier is a compound containing one or more condensation cure groups and one or more hydrophobic groups.
9. A method according to claim 8 wherein the surface modifier is a compound of the formula $\text{SiR}^1(\text{OR}^2)_3$, where R^1 is alkyl, vinyl, epoxyalkyl, methacrylate or perfluoroalkyl, and each R^2 is independently selected and is methyl, ethyl or acetyl.
10. A method according to any one of claims 1 to 9 wherein the particulate material comprises silica particles.
11. A method according to claim 10 wherein the silica particles are flame hydrolysed silica particles.
12. A method according to any one of claims 1 to 9 wherein the particulate material comprises metal particles, glass particles or particles of a metal oxide.
13. A method according to claim 12 wherein the metal oxide is titanium oxide, aluminium oxide, zirconium oxide or zinc oxide.
14. A method according to any one of claims 1 to 13 wherein the particles of the particulate material have an average particle size of from 1 nm to 500 μm .
15. A method according to claim 14 wherein the average particle size of the particles of the particulate material is in the range of from 1 nm to 50 μm .
16. A method according to claim 15 wherein the average particle size of the particles of the particulate material is in the range of from 1 nm to 50 nm.
17. A method according to any one of claims 1 to 16 wherein the decomposable

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surfactant is polyether modified polydimethylsiloxane, polyethoxylate modified polydimethylsiloxane, pyridinium or 1-[2-(octadecyloxy)-2-oxoethyl]-chloride (9Cl).

5 18. A method according to any one of claims 1 to 17 wherein the organic solvent is selected from toluene, ethylacetate, xylene, hexane or diethyl ether.

10 19. A method according to any one of claims 1 to 18 wherein step (c) comprises heating the coating to a temperature and for a time effective to remove all or substantially all of the water and the organic solvent from the coating and for the particles of the particulate material to become bound together and to the surface.

15 20. A method according to any one of claims 1 to 19 wherein step (d) comprises heating the coating to a temperature and for a time effective to decompose the decomposable surfactant.

20 21. A method according to any one of claims 1 to 20 wherein steps (c) and (d) are carried out simultaneously.

25 22. A method according to any one of claims 1 to 20 wherein step (c) is carried out prior to step (d).

25 23. A method according to any one of claims 1 to 22 wherein the hydrophobic coating formed by the method has a thickness of less than 100nm.

30 24. A hydrophobic coating formed by the method according to any one of claims 1 to 23.

30 25. An object having a surface at least a portion of which is coated with a hydrophobic coating formed by the method according to any one of claims 1 to 23.

35 26. A transparent hydrophobic coating on which water has a contact angle of at least 130°.

35 27. A method of forming a hydrophobic coating on the surface of a substrate, the

method comprising the steps of:

- (a) forming an emulsion comprising particulate material, wherein the particles of the particulate material have an average particle size in the range of 1 nm to 50 μm , a decomposable surfactant, water, an organic solvent, and a linking agent capable of reacting with the particles of the particulate material and the surface to bind the particles together and to the surface;
- (b) applying the emulsion to the surface to form a coating on the surface;
- (c) exposing the coating to conditions such that all or substantially all of the water and the organic solvent are removed from the coating, and the linking agent reacts with the particles of the particulate material and the surface to bind the particles together and to the surface; and
- (d) exposing the coating to conditions such that the decomposable surfactant decomposes.

15 28. A method according to claim 27 wherein the particulate material comprises silica particles.

29. A method according to claim 27 wherein the particulate material comprises metal particles, glass particles or particles of a metal oxide.

20 30. A method according to any one of claims 27 to 29 wherein the particles of the particulate material have an average particle size of from 1 nm to 5 μm .

25 31. A method according to any one of claims 27 to 30 wherein the linking agent is a bifunctional or trifunctional alkylsilane.

30 32. A method according to claim 31 wherein the linking agent is methyltrimethoxysilane, vinyltrimethoxysilane, methyltris(methylethylketoximino)silane, methyltriacetoxysilane, ethyltriacetoxysilane or vinyltriacetoxysilane.

35 33. A method according to any one of claims 27 to 32 wherein step (c) comprises heating the coating to a temperature and for a time effective to remove all or substantially all of the water and organic solvent from the coating and to cause the linking agent to bind the particles together and to the surface.

.34. A method according to any one of claims 27 to 33 wherein step (d) comprises

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heating the coating to a temperature and for a time effective to cause decomposition of the decomposable surfactant.

35. A hydrophobic coating formed by the method of any one of claims 27 to 34.